# ECEN 150 Lab 1 – Voltage and Current

Name:

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## Purposes:

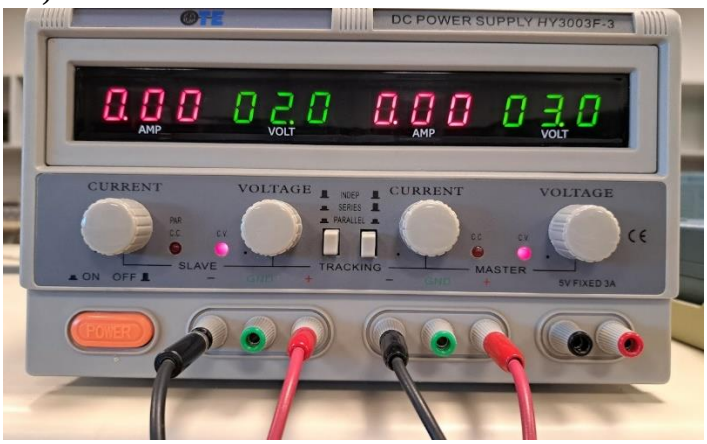
- Become familiar with digital multimeters and power supplies.
- Learn how to measure voltage between two points and with respect to ground.
- Learn how to measure current.

## Procedure:

**Part 1. Measure DC voltages**.

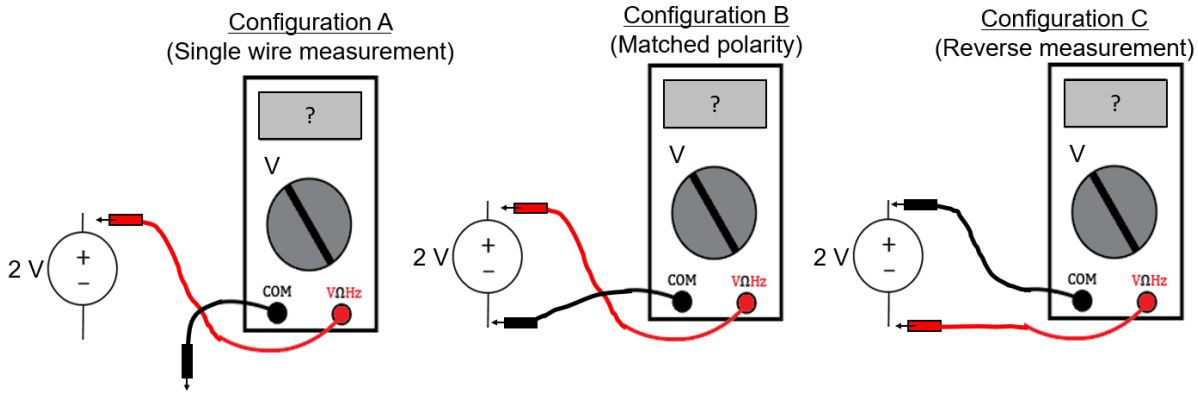
Step 1: Configure the DC supplies.

- Turn on the DC power supply.
- Set the supplies to "Independent" (both buttons are NOT depressed).
    - *This setting allows the two supplies to be configured independently from each other.
- Set the left variable supply to 2 V.
- Set the right variable supply to 3 V.
- Spin the "current" knob on each supply all the way to the left (counterclockwise). Then, turn them just slightly to the right (clockwise).
    - *This sets the max current of the supplies to a small value as a safety precaution.
- Connect a pair of black/red banana-to-alligator cables to the black/red terminals of the supplies (not the green).




Step 2: Use the digital multimeter to measure the specified voltages.


- Set the multimeter to measure DC voltages. (see photo)
- Connect a pair of banana-to-alligator cables to the multimeter.
    - Black cable: connect to "COM". This is the reference terminal for the voltage measurements.
    - Red cable: connect to the voltage measurement input (see the labels on the meter).
- Use the multimeter to measure the supply voltages using the different configurations shown in the diagram below. Record your results in the table.




Record your measured values here: (include decimal points) (6 points)

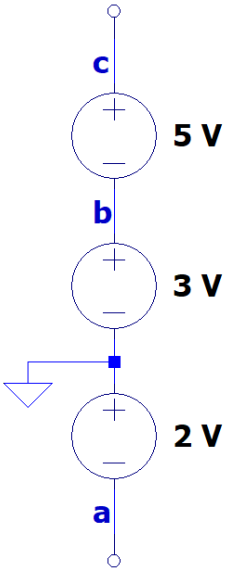
| Voltage source | Configuration A | Configuration B | Configuration C |
|---|---|---|---|
| 2 V (left) | 0 | 2 V | -2 V |
| 3 V (right) | 0 | 3 V | 3 V |

**Question 1**: The supplies are set to deliver (positive) +2 V and +3 V. Why don't all the measured values match the output setting of the supply? Why were some negative and some zero? Explain the results from each of the three configurations. (6 points)

When you measure from positive to negative you'll get a negative and from negative to positive you'll get a positive. It just depends on which one you're subtracting from which. Then 0 is when theres either no circuit or no difference of charge.

Step 3: Measure stacked DC voltages.

- Connect the supplies as shown in the adjacent schematic.
  - The 5 V supply is the "fixed" supply with the two terminals on the far right.
  - The ground connection is the green terminal.
- Calculate and then measure the following voltages and enter your result in the table. The measured values should match the calculated values. *If no reference point is specified, use Ground for both the measurement and calculation. (10 points)



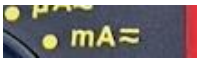

| Voltage | Calculated (expected) | Measured |
|---|---|---|
| $V_b$ | 3 V | 3 V |
| $V_c$ | 8 V | 8 V |
| $V_a$ | -2 V | -2 V |
| $V_{cb}$ | 5 V | 5 V |
| $V_{ca}$ | 10 V | 10 V |

**Question 2**: How did you know where to connect the measurement probes in each case? Explain the nomenclature in the left column of the table. Why is $V_a$ negative, yet $V_{ca}$ is the largest positive value in the table? (6 points)

For the first three with just one point, the second is implied to be the ground. So we connect one to the point and the reference to the ground. Va is negative because it goes from 0 to 2 (0 – 2), while Vca is going from 8 to -2 (8 - -2).

**Part 2. Measure DC current**.

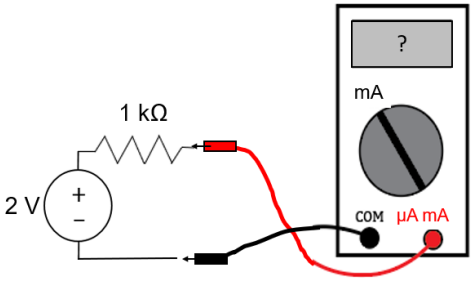
Step 1: Configure the DC supplies.

- ***Turn off the supplies.***
- **Disconnect the multimeter.**
- Disconnect all power supply cables.
- Obtain a 1 kΩ resistor, then connect the circuit as shown in the schematic below.
- Configure the multimeter to measure DC current.
  - Flip the switch to "mA": 

  - Move the red cable to the "µA mA" terminal: 

- **Have the TA or instructor check your circuit before turning the supply on again.**
  - *This is to prevent accidental damage to the multimeter.
- Record the current you measured here. Include units. (Should be close to 2 mA): (2 points)

| Measured: 2mA |
|---|




**Question 3**: Is current measured across the resistor, or through it? Why did we connect the meter the way we did in order to measure this current? Why did we break the circuit and make the meter part of the current path? (6 points)

| Through it because we didn't measure on either side of the resistor, but connected the multimeter as part of the circuit to make it flow in one path. |
|---|

*****To pass off your circuit, demo it to the TA or instructor and take Lab 1: Quiz 1*****

**Part 3. Conclusions statement.**

Write a brief conclusions statement that discusses all of the original purposes of the lab. Please use complete sentences and correct grammar to express your thoughts on how you fulfilled the purposes of the lab:

## Purposes (repeated):

- Become familiar with digital multimeters and power supplies.
- Learn how to measure voltage between two points and with respect to ground.
- Learn how to measure current.

1. What do voltage supplies do? Why is it important to understand the polarity of the supply?
2. What functions of the digital multimeter did we use today? Why did orientation of the measurement probes matter?
3. Is voltage a single-terminal or two-terminal measurement? Is voltage measured across or through a device?
4. How is current measured? (must the current flow through the meter?)

Conclusions (10 points):

1. Voltage supplies separate charge to make a difference of charge so the electrons want to move and get back to where they're happy. It's important to understand the polarity so you know how and which way the current is flowing so you don't blow up the circuit and get an accurate reading.
2. We used the DC Voltage measuring function and the mA current measuring function. It mattered because for voltage we were just measuring it across two points in the circuit, but

for measuring the current we had to make the multimeter part of the circuit and flow through it. So the different orientations accounted for this difference.

3. Voltage is a two-terminal measurement because it's measured across the device, meaning it's measured across two points.
4. Current is measured by making the current flow through the multimeter as part of the circuit. The multimeter then measures the amount of charge that passes through it per second.

Congratulations, you have completed Lab!
You may now submit this document.